December 24, 1959

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Dear Ed:

Further to our discussion of syndilonic beams (i.e. clusters of alternating charge) in the accelerator. Since last March, I had not given very much thought to this, since it is so far from my main interests, but after our discussion I was moved to look more closely at the literature on negative ions. The outlook for useful sources of such ions may be brighter than I had previously thought.

1) Enclosed is one explicit, though roundabout, approach to a mixture of Cs^+ and I^-. The complication is perhaps slightly mitigated by having to accelerate a Cs^+ beam in any case.

2) Resonant capture of electrons may figure prominently. Hickam and Berg, J. Chem. Physics 29: 517, 1958 refer to the formation of F^-, SF_6^- and SF_5^- ions through the capture of ~ .1 volt electrons in SF_6. The relative yields depend quite a bit on temperature, energy spectrum and other gases in the mix. One might be fortunate in the balance that Cs^+ = [illegible] 133; = SF_5^- = 127. I^- has also been described as arising by electron impact of I_2+ e. These references suggest sufficient groundwork to test some of the basic merits of a syndilonic beam.

3) I would also revert to the more fanciful suggestion of exposing an (? oriented)crystal to high intensity microwave fields, with the aim of dislodging alternate groups of ions for further acceleration. These would correspond to the field currents from metals. The work function from, say CsI crystals, is perhaps very high, and it might be worth looking for catalysts to reduce this. Do you know of any experimental work looking for such currents? (Since the characteristic frequency may be in the tenth-millimeter range, we may be asking questions about the <u>generation</u> of power in the most difficult region.)

With best wishes for the season,

Yours cordially,

Joshua Lederberg

Enc: p. 77 from Massey, Negative Ions, Cambridge, 1950.